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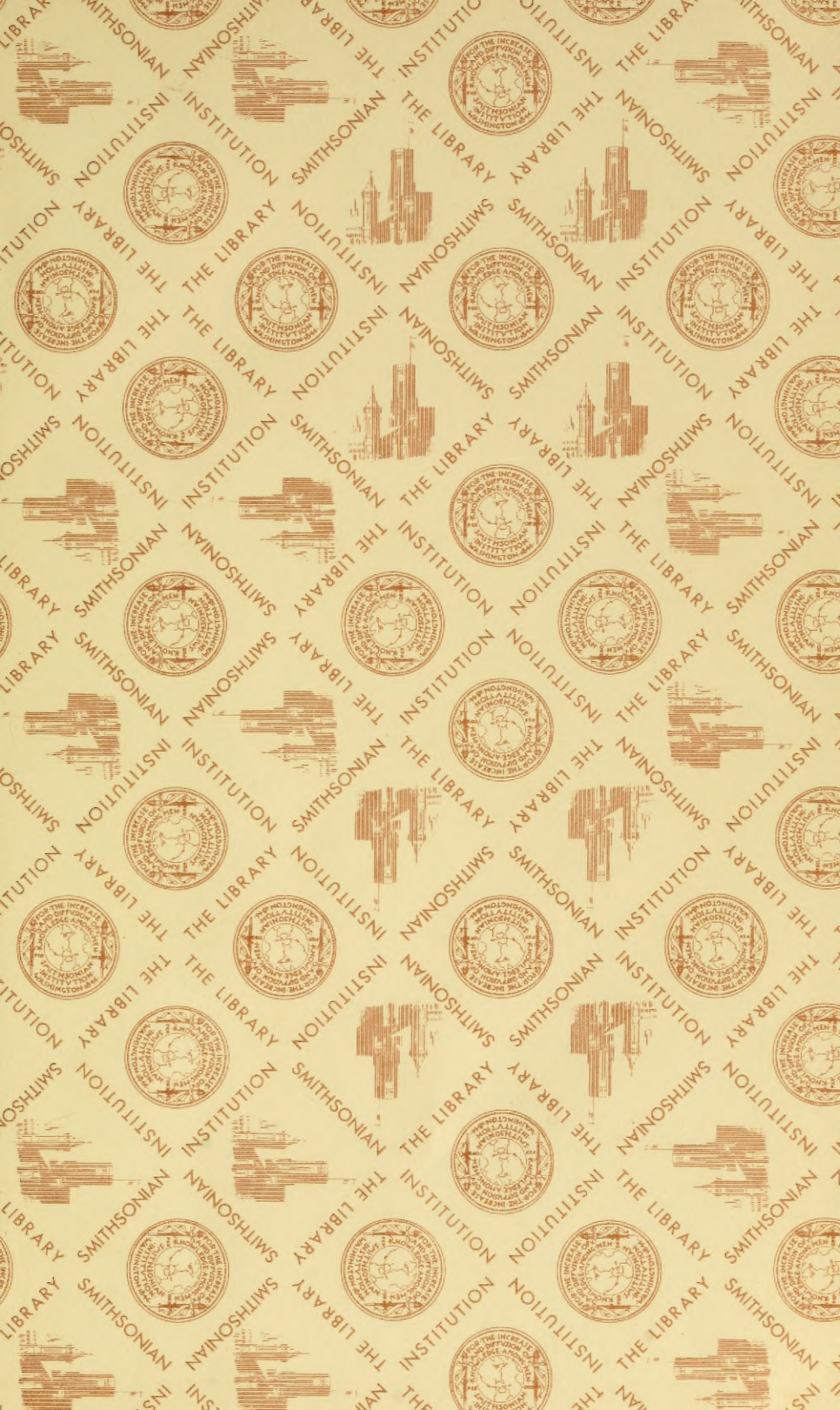
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THE CLASSIFICATION

OF THE

RHYNCHOPHOROUS COLEOPTERA.*

BY

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[Reprinted from the AMERICAN NATURALIST for July, 1874.]

At the meeting of the Academy held in Washington, Jan., 1867, I had the honor to offer some remarks† upon the systematic value of the great complex of Coleopterous insects known as Rhynchophora.

It was my intention, as then stated, to follow the memoir just mentioned with another, in which the classification of the Rhynchophora and separation into families should be discussed, in the hope of developing a more satisfactory system of arrangement than had been thus far obtained.

Circumstances have prevented me from following this particular line of investigation to a definite result, until within a short time, though it has frequently occupied my attention for brief intervals. The time, however, has not been altogether lost, for I found that, with each return to the investigation, I obtained an additional, though small insight into the constitution of this complex, which has been the subject of repeated efforts by the most laborious and successful students of entomology in Europe.

* Read before the National Academy of Sciences, Washington, April 21, 1874.

† Am. Jour. Science and Arts, xliv, July, 1867.

The bases of the classification of the Rhynchophora which have been proposed are briefly these:

I. Schonherr* treated the great mass of these insects (excluding only the Scolytidæ), as constituting a single family, divided as follows: —

A. Antennæ not geniculate; antennal grooves wanting; ORTHOCERI.
Bruchides, Anthribides, Camarotides, Attelabides, Rhinomacerides, Ithycerides, Apionides, Rhamphides, Brenthides, Cylades, Ulocerides, Oxyrhynchides.

B. Antennæ geniculate; grooves almost always distinct; GONATOCERI.
a. Rostrum short, deformed, antennæ subterminal; *Brachyrhynchi.*
*Antennal grooves extending below the eyes; Brachycerides, Entimides, Pachyrhynchides, Brachyderides, Cleonides, Molytides, Byrsopides (the last with the rostrum received in aprosternal excavation).
** Antennal grooves directed towards the eye;
Phyllobiides, Cyclomides, Otiorhynchides.
b. Beak cylindrical, slender, antennæ inserted far behind the tip: Erirhinides, Cholides, Cryptorhynchides, Cionides, Rhynchophorides, Conoderides, Cossonides, Dryophthorides. *Mecorhynchi.*

In the gradual progress of the work this last legion, the Mecorhynchi, were divided into Synmerides, having the front coxæ contiguous, and Apostasimerides, having them distant.

The distinctions between the tribes above mentioned were founded mostly on insignificant and evanescent modifications in the form of the beak and antennæ; so that with the immense mass of genera and species described, it became quite impossible to determine either from the work itself.

II. Although the faults found with this artificial system were neither few nor vaguely expressed, yet it was not until the progress (1863) of his admirable work on the Genera of Coleoptera by my deceased friend Prof. Lacordaire required this immense labor to be done over again, that any attempt was made at a new arrangement; the system of Lacordaire was essentially this:

The series was divided into six families; Curculionidæ, Bruchidæ, Anthribidæ, Brenthidæ, Uloceridæ and Scolytidæ. Of these the Bruchidæ were recognized as having scarcely any relations

* Genera et Species Curculionidum, Paris, 1833–1844.

with the other families, and pertaining rather to the Chrysomelidæ, with which they have since been associated by most authors.

The Bruchidæ and Anthribidæ were characterized by having a distinct labrum; the Scolytidæ by the compressed and dentate tibiæ, while the Brenthidæ were separated rather by form than by any distinct structural character.

The Curculionidæ were then divided according to the size of the mentum, into

I. Mentum closing the buccal space, and concealing the maxillæ . . . . . ADELOGNATHI.
Eyes rounded, prothoracic lobes indistinct, . . . *Cyclophthalmes.*
Eyes large, depressed, transverse, narrowed below, prothoracic lobes well marked, ... *Oxyophthalmes.*
II. Mentum smaller, maxillæ visible . . . . . PHANEROGNATHI.
A. Front coxæ contiguous or nearly so, . . . *Synmerides.*
a. Pygidium covered by the elytra; claws not appendiculate.
Metasternum short; episterna narrow;
Gular peduncle wanting:
Gular peduncle distinct:
Metasternum long; episterna rather wide:
Antennæ geniculate:
Antennæ straight.
b. Pygidium exposed, *or* claws appendiculate:
Ventral segments not angulated at the sides:
" " angulated:
B. Front coxæ separated by the prosternum, which is frequently channelled for the reception of the beak, . *Apostasimerides.*
a. Oral organs normal. Club of antennæ annulated; 3d joint of tarsi bilobed.
Mesothoracic epimera not ascending:
" " ascending.
b. Oral organs abnormal; 1st joint of antennal club usually very large, corneous, 3d joint of tarsi rarely bilobed.
Pygidium exposed.
" covered by elytra.

Each of these divisions contains several tribes differentiated by characters of smaller importance, and not unfrequently indefinite.

III. The next attempt at a general classification was made by Mr. H. Jekel.* This excellent author recognized with great clearness, and defined with tolerable precision, the following eight

* Annales Ent. Soc. France, 1864, p. 537. Ins. Saundersiana, 155 sqq., 1860.

principal types among the Rhynchophora: Bruchides, Anthribides, Attelabides, Curculionides, Calandrides, Cossonides, Scolytides and Brenthides. The last cited memoir is occupied chiefly with a further development of the classification of the largest of these, the Curculionides proper, and in it he proceeds to separate as sub-families* Brachycerides, Byrsopides and Amycterides, epigeal forms in which the tarsi are not dilated, and not furnished with brush-like hairs beneath. Having thus isolated them the great mass remaining is divided into

Body dissimilar in form ♂, ♀, narrower in ♂	PLATYGNES.
Beak similar in both sexes	*Homorhines.*
Beak dissimilar	*Heterorhines.*
Body nearly or quite of the same form ♂ ♀ :	
Pygidium covered by the elytra, body pollinose or pubescent	ISOGYNES.
Pygidium exposed or covered; body squamose, etc.	METRIOGYNES.
Pygidium covered	*Cryptopyges.*
Pygidium exposed	*Gymnopyges.*

The principal types contained in each of these three grand divisions are then characterized in a very clear manner; but for a proper understanding of this system, a vast improvement on all that preceded, the reader must refer to the original memoir. In developing the arrangement of the tribes represented in our fauna, I shall be largely indebted to the views expressed in this most valuable memoir of Mr. Jekel.

There remain to be mentioned two faunal contributions to the history of this subject:

1. A series of remarks by Mr. Suffrian,† in which the German species of several genera, not before carefully studied, are more fully elucidated, and various criticisms upon Schönherr's system made.‡ The necessity of a more careful study of the tibiæ and tarsi, almost neglected by Schönherr is insisted on, and an arrangement of the German genera in groups upon these characters is given.

2. That most admirable work of Prof. C. G. Thomson,§ to

* Mr. Jekel gives to the anomalous groups this subordinate position, rather, as he says "pour ne pas heurter les idées généralement admises," than in accordance with his own views, which would lead him to regard them as I have done, as genuine families.

† Bermerkungen über einige deutsche Rüsselkäfer: Stettin, Ent. Zeitsch. i-ix.

‡ See specially *op. cit.*, 1847, 157.

§ Skandinaviens Coleoptera, vii, Lund, 1865.

which no entomologist ever refers without finding original material by which he can profit; a remarkable instance of the good results to be obtained by a careful and intelligent study of a very limited fauna. The Rhynchophorous series is divided as follows:

Segments of the abdomen immovable, 2d and 3d nearly equal
ISOTOMA.
Bruchidæ, Anthribidæ (including Urodon), Rhinomaceridæ, Attelabidæ.
Abdomen with the 1st and 2d segments connate, the remaining three movable, the 2d usually much longer than the 3d . ANISOTOMA.
Apionidæ, Curculionidæ, Cossonidæ (including Calandra), Tomicidæ.

From a survey of the different schemes of arrangement which have been thus briefly reviewed, it is evident that while the principal types of the Rhynchophorous series, and the main divisions of the great family Curculionidæ have been clearly perceived, the attempts to define these important forms have failed in a greater or less degree, on account of the want of proper subordination in the characters made use of: all of them natural, all of them important, though in a less degree than supposed by the expounder of each particular system.

To supplement the memoirs above referred to, there came in more recent times the beginning of a systematic study of our species of Curculionidæ by Dr. George H. Horn, a careful and conscientious study of the Calandridæ and Cossonidæ and of some Mecorhynch genera of the United States.* In the introductory remarks he observes:—

"One character is mentioned in the following pages that appears to have escaped notice. In most if not all of the genera of *Mecorhynques*, the males have eight and the females seven dorsal abdominal segments. The *Calandrides* and *Cossonides* appear not to possess this character, as also all the *Brachyrhynques* which I have had time to examine."

The value of this original observation of Dr. Horn is very great, but the limitation which he has placed upon it, though correct as regards the Calandride and Cossonide types, is erroneous as regards the Brachyrhynes, which have the abdominal sexual characters precisely as in the genera in which he first observed them. So too have the Brenthidæ, and all the anomalous sub-families of Curculi-

*Contributions to a Knowledge of the Curculionidæ of the United States. Proc. Am. Philosophical Soc. 1873, 407.

onidæ in the Jekelian system. It appears therefore that this peculiarity of structure is of much more importance than was supposed by Dr. Horn, and that it must in reality be the defining character for the division of the Rhynchophora into primary series, of more than family value. I therefore prepared a series of dissections of each of the well recognized Rhynchophorous types within my reach, and have come to the conclusion that they may be arranged in three sets, each of which has a corresponding value to the individual series of normal Coleoptera (*e.g.*, Adephaga, Clavicornia, Lamellicornia, etc.); and upon subordinate characters (some of which have been already employed in the classifications above mentioned, though in an empirical manner) into families as follows.

Series I. HAPLOGASTRA.

Abdomen alike in both sexes; dorsal segments 7, coriaceous, with the exception of the 7th which forms the pygidium, and which is small and corneous; ventral segments not prolonged upwards into a sharp edge; elytra without lateral fold on the inner surface, epipleuræ usually distinct, antennæ straight, 11-jointed. Ungues usually bifid or toothed, rarely (Rhinomacer) simple; Front coxæ conical, prominent, prosternum very short in front of the coxæ. The beak varies in length and thickness, but not according to sex, so far as I know: the front coxæ are contiguous, except in one genus of Rhynchitidæ (Pterocolus); the ventral sutures of the abdomen are straight. The mandibles and tibiæ vary in form, and furnish convenient characters for division into families:—

A. Ventral segments nearly equal in length; epipleural indistinct; tibial spurs small; claws simple (always ?). Mandibles simple, flat; labrum distinct . . . . . Rhinomaceridæ.

B. Ventral segments diminishing in length; epipleuræ distinct; labrum wanting; claws bifid, or appendiculate

Mandibles flat, toothed on each side; tibial spurs small Rhynchitidæ.

Mandibles stout, pincer shaped, tibial spurs large Attelabidæ.

The affinities of this series are in an ascending direction with the rostrated Heteromera (Oedemeridæ and Pythidæ); this is indicated by the softer tissues in Rhinomaceridæ, and certain Rhynchitidæ, and also by the presence of a labrum in the former. In a descending direction the Attelabidæ lead to the true Curculionidæ,

and the Rhynchitidæ to the Belidæ, the last family in the third series of Rhynchophora.

The habits of the species of this series are peculiar, and quite different from those of the next series, and indicate as is wisely observed by Lacordaire,* for the care of their progeny, an industry which appears here for the first time in the family. I cannot describe the results of this instinctive or intelligent industry better than by condensing the account of the author just cited, referable however to European species.

1. Rhinomaceridæ. The European species deposits the eggs in the male flowers of *Pinus maritimus*, the development of which is thus prevented. I may be allowed to observe that this synthetic genus, the nearest approach in the Rhynchophora to the lower Heteromera, and therefore the representative of old forms, clings to an old and synthetic type of vegetation.

2. Rhynchitidæ. Some of the species of Rhynchites roll leaves in the manner of the next family. Others deposit their eggs in young fruit, the kernel of which is eaten by the larva; others again place the eggs in the undeveloped buds of trees, which are thus destroyed.

3. Attelabidæ. In the spring the females roll up the leaves of trees, and deposit in each an egg. After emerging from the egg the young larvæ eat the inside layer of the case which covers them, which they probably leave at a later period, when their growth is complete, to perfect their metamorphosis under ground.

These three families are of small extent, and but little need be said regarding their classification.

RHINOMACERIDÆ.

This family is represented in our fauna by two species, one on each slope of the continent, and is easily recognized by the depressed, curved and acute mandibles, and distinct labrum. The pygidium is covered by the elytra, which are punctured without any appearance of striæ. On the inner face there is no trace of a lateral fold: the epipleuræ are indistinct.

ATTELABIDÆ.

Four species of Attelabus on the Atlantic slope are the only representatives thus far known in our fauna. The beak is stouter

*Gen. Col. vi, 543.

than in the preceding family, and the mandibles thicker and stronger. The epipleuræ are quite distinct, and there is no trace of a lateral fold on the inner face of the elytra. The pygidium is not covered by the elytra, and is impressed along its upper margin for the reception of the apical edge of the elytra.* The tibiæ are armed with large spurs.

RHYNCHITIDÆ.

The peculiar form of the mandibles requires the separation of these genera as a distinct family. The teeth on the inner side are well developed as usual, but in addition, the apex is prolonged outwards into an acute process, behind which is another large tooth.†

The front coxæ are usually contiguous, large and conical, in one genus (Pterocolus) widely separated. The pygidium is either exposed (Rhynchites, Pterocolus) or covered by the elytra (Eugnamptus, Auletes). The epipleuræ are narrow, but distinct, and on the inner face of the elytra remote from the margin may be seen a short straight fold, the homologue of the well defined fold which limits the lateral groove for the reception of the side margin of the ventral segments observed in all the following families.

Series II. ALLOGASTRA.

Abdomen dissimilar in the two sexes; dorsal segments 1–6 coriaceous or membranous, 7th large, corneous, undivided in ♀, divided into two in ♂; ventral segments prolonged upwards forming a sharp edge, fitting into a corresponding groove on the inner face of the elytra, which are without epipleuræ.

The beak and oral organs vary greatly in form, as do also the antennæ, the tarsi, the ungues, and the position of the coxæ; the 1st and 2d ventral segments are most frequently connate, and the 3d is always shorter than the 2d; the 5th is longer than the 4th.

The following families seem to be indicated by the material I have examined:—

A. Antennæ with a solid annulated club:
  a. Tarsi narrow:
    Gular margin very prominent; mentum retracted;

* Compare in this relation the curious notch in the front part of the pygidium of Anthribidæ, for the reception of the sutural angles of the elytra.

† This character was first observed by Thomson, who observes (Sk. Col. vii, 28) concerning his tribe Rhynchitina, "mandibulæ depressæ, extus excisæ, intus dentatæ."

Prosternum not excavated; . . . . . AMYCTERIDÆ.
Prosternum excavated: . . . . . BYRSOPIDÆ.
Gular margin not prominent, mentum large, concealing the mandibles, which are not scarred at tip BRACHYCERIDÆ.
b. Tarsi dilated, usually with a brush of hair beneath:
Mandibles with deciduous tip, leaving a scar OTIORHYNCHIDÆ.
Mandibles simple, usually pincer-shaped. . CURCULIONIDÆ.
B. Antennæ with 11 separate joints. . . . BRENTHIDÆ.

Concerning Amycteridæ and Brachyceridæ, but little need be said. They are very peculiar and easily recognized forms, not represented in our fauna.

The first is Australian; the antennæ are slender, and geniculated; the beak short and stout, deeply emarginate at tip, alike in both sexes; the buccal opening is very large, and the cavity is filled almost completely by the mandibles, which are convex, hairy on the greater part of the front surface, deflexed, deeply concave beneath; the gular margin is thickened and prominent, so that a deep cavity is seen between the gula and the mandibles, in which the mentum and oral organs are concealed from view; the eyes are small and nearly round in some, narrowed beneath in others. The front coxæ are contiguous, the prosternum very short; the elytra are connate and extend far over the flanks, so that the side pieces both of the meso- and metathorax are concealed. The dorsal segments of the abdomen are membranous, except the last which is very large, corneous, and convex, more so in ♂ than in ♀, in the former it is truncate behind, exposing a semicircular 8th segment, from under which protrudes (Psalidura) a very powerful and complex genital armature, consisting of a large pair of forceps, conical obtuse, punctured and hairy, under which and seen only from below is a pair of transverse, thin, polished, corneous plates, also meeting on the median line; between them and the forceps is a large deep cavity. The ventral segments are scarcely less singular; the 1st and 2d segments large, flat, connate, united by a sinuate suture; 3d and 4th very short, separated by deeply excavated straight sutures, 5th much larger, in ♂ very deeply and semicircularly excavated, almost to the base, with a tuft of stiff bristles each side at the front edge of the excavation; in the ♀ this segment is flat, and meets the last dorsal at tip in the usual manner; on the sides the lateral upward extension of the 5th ventral is very large, but the spiracle is visible; the extension of the 4th and 3d segments

are much smaller, and imbricated upon the 5th and 4th respectively; the side margin of the 1st and 2d is very narrow, and the side pieces of the metasternum are scarcely visible. The elytra are connate, with the lateral groove of the inner face narrow and sharply defined, becoming broader and indefinite at the posterior fourth; on the inner face are seen eight rows of punctures, corresponding to ridges of tubercles on the back. The tarsi are 4-jointed, narrow, or at least the 3d joint not wider than the others, deeply grooved beneath; the tibiæ are truncate, without spurs, the front pair a little incurved at tip in both sexes. Claws simple, not contiguous.

The genera of this family are stated by Mr. Jekel,* to differ by the form of the eyes, some being Cyclophthalmes, others Oxyophthalmes; also in the antennal grooves, some being Obliquiscrobes, others Lateriscrobes. The vestiture of the under surface of the tarsi varies in different genera; in Psalidura they are spongy sericeous beneath, in others ciliate or spinous.

In other genera, the sexual characters are less remarkable than in Psalidura, and will be found to consist chiefly in the division of the last dorsal segment into two, as in the other families of the series.

The Brachyceridæ are restricted to Africa and the neighboring parts of Europe and Asia. They are stout insects, with ventricose elytra, suddenly deflexed behind, and extending far upon the flanks, like the first tribes of Tenebrionidæ, which they also resemble in the large mentum, flat, filling the whole of the buccal cavity. The beak is short and stout, thicker at the extremity, alike in both sexes; the antennal grooves are wanting (Episus); or deep and directed downwards, almost confluent in the gular region (Brachycerus, Microcerus). The antennæ are short, straight or feebly geniculate, scape forming less than $\frac{1}{3}$ the length; joints of the funiculus 7, rather short, club solid, obconical, truncate or subacuminate at tip. Eyes rounded or transverse and acuminate at the lower end. Mandibles stout, short, more prominent in Brachycerus, where they have the lower margin more produced into a cutting edge: the front surface is rough and somewhat angular, but without any trace of the rounded scar seen in Otiorhynchidæ. The scutellum is scarcely visible; the elytra, as above mentioned, are ventricose, irregularly tuberculate or costate, very

* Ann. Ent. Soc. France, 1864, 544.

much extended on the flanks, so as to cover the side pieces of the meso- and metathorax; greatly deflexed behind. The lateral groove of the inner face is deep and narrow, becoming wider and obsolete behind. The dorsal segments are membranous, except the last, which is corneous, and divided in ♂ into two as in Curculionidæ. The ventral segments are separated by deep sutures, of which the 1st is sinuate; the 3d and 4th segments are shorter than the others: the lateral extension upwards is narrow; and but slightly wider behind. The front coxæ are contiguous, prominent and subconical, the tibiæ are not dilated, the spurs are small, fixed, projecting inwards, the tarsi 4-jointed, narrow, setose and feebly concave beneath (Brachycerus); pubescent, concave and emarginate beneath (Microcerus); claws large, simple, distant.

BYRSOPIDÆ.

The third of the anomalous families has a more general distribution, and is represented in our fauna by the genus Thecesternus, which forms a separate tribe, distinguished from the other tribes by the prosternal groove for the reception of the beak not extended as far as the front coxæ.

These insects are epigeal, rough and dull colored, with the elytra widely embracing the flanks, but not strongly deflexed behind, concealing the side pieces of the trunk. The beak is very short, not thickened at tip, nor emarginate at the middle; the antennal grooves descend perpendicularly and form a gular constriction: the antennæ are unusually short, imperfectly geniculate, the scape as long as the 1st and 2d joints of the funiculus; the club elongate oval, pointed, distinctly annulated. Eyes transverse, pointed beneath.* Mandibles stout, short, front surface curved and roughly punctured; mentum very small, not placed on a gular peduncle; maxillæ exposed. Prothorax widely lobed in front at the sides, so as to conceal the eyes, when the head is deflexed; deeply excavated beneath for the reception of the beak, cavity closed behind in Thecesternus by a triangular plate of the prosternum, but by the front coxæ in the other genera; coxæ small, globose, contiguous. Elytra connate, widely extended on the flanks, declivous behind, rough; lateral groove of inner face narrow, and well defined; scutellum not visible; humeri in The-

* Jekel, l. c. 1864, 543, describes the group as being *Adelognathes cyclophthalmes*: Lacordaire (Gen. Col. vi, 293 sqq.) places them in Phanerognathes, and describes the eyes as acuminate below, in which he is correct.

cesternus prolonged forwards, so as to extend along the sides of the prothorax. Dorsal segments membranous, last one large, corneous, divided into two in ♂ : ventral segments unequal, 1st and 2d very large, more closely connected, suture arcuated : 3d and 4th short, sutures deep, 5th as long as the two preceding ; lateral extension moderately wide, wider behind, pygidium articulating with both 4th and 5th ventrals. Legs slender, tibiæ truncate, spurs small, tarsi 4-jointed, narrow, setose beneath.

Several species of Thecesternus are found in the interior regions of the continent, from Illinois to Utah, under dried buffalo excrement, and similar objects.

OTIORHYNCHIDÆ.

In a large number of genera* of Rhynchophora, at the front part of the mandibles, may be seen a round or oval depression, having the appearance of a scar, and which served, during the pupa stage, and for the early part of the imago life, as an attachment for a deciduous piece, of a conical and usually slender form. Many times specimens had occurred in which one or both of these pieces were still adherent, and the explanations thereof were varied and incorrect.† The opinion of Lacordaire seems to be quite satisfactory, that they are probably of service in enabling the insect to cut its way out from the nest or cell in which the transformation takes place.

While recognizing the frequent occurrence of this singular structure, altogether without parallel among other insects, it does not seem to have occurred to Lacordaire, that we have here a character of great importance for systematic purpose, and that after removing the large mass of such genera, the normal series of Curculionidæ would be much more amenable to classification. In fact I think it may be shown that the confusion and indefiniteness of the first part of the classification of Lacordaire is mainly owing to the intercalation of genera with scarred mandibles and those with simple mandibles. I have therefore placed the former as a separate family, having the following general characters.

The body affects two forms ; in the apterous species the elytra are connate and convex with the humeri rounded ; in the winged species they are more oblong, with the humeri more or less prom-

* Lacordaire, Gen. Col. vi, 5 (note).
† Müller, Germar's Mag. iii, 424.

inent. The beak is alike in both sexes, usually short and broad, sometimes longer and thickened or dilated at tip, which is emarginate; the antennal grooves are either (1) on the upper surface of the beak (Otiorhynchus), in which case they are short, and not bent downwards; (2) longer, lateral, and directed towards the eyes or (3) long or short, directed obliquely below the eyes; they always extend nearly to the apex. The mandibles are short and thick, pincer-shaped, with an apical scar, which varies somewhat in different genera, to which was attached a deciduous piece also of variable form; very long and falcate (Phyllobius, etc.), long and straight (Trigonoscuta), or short and obtuse. The mentum is large, and fills the buccal space, except in Eudiagogus, where it is small, leaving the maxillæ exposed. The antennæ are geniculate, with the scape usually very long; the club is pubescent and annulated. The eyes are usually rounded, but in several genera transverse and pointed below; in the latter case, but also in some of the round-eyed genera, the front margin of the prothorax is dilated forming post-ocular lobes; these lobes are sometimes very feeble and sometimes indicated only by a marginal row of long hairs (*vibrissæ* of Lacordaire). The front coxæ are contiguous in our genera. The trunk is short, even in the winged species, the epimera of the mesothorax project below the elytra to a greater or less extent; the episterna of the metathorax are either covered by the elytra, and indistinct, or narrow and very distinct. The hind coxæ are usually widely separated, the ventral segments are 5 (in one specimen of Nocheles but 4 are visible); the 1st and 2d larger, connate, 3d and 4th shorter, 5th a little longer. The lateral extension of the ventral segments is tolerably wide, broader behind; the dorsal segments are membranous, the last is corneous, divided in ♂ as usual, but the terminal portion apparently more retractile than in genuine Curculionidæ. The legs are moderate, tibiæ variable in form, tarsi spongy beneath, usually dilated, though sometimes (Ophryastes) very slightly so, and in Rhigopsis only sparsely ciliate.

The tribes of this family so far as represented in our fauna may be naturally grouped as follows:—

A. Side pieces of metathorax concealed, or indistinct; elytra connate: Antennal grooves short, on the upper face of the beak; or lateral and directed towards the eyes, eyes rounded, or nearly so, prothorax not lobed. . . . . Otiorhynchini.

Antennal grooves lateral, directed below the eyes, which are rounded, prothorax not lobed: . . . . . BRACHYDERINI.
Directed below the eyes, which are sometimes transverse, prothorax more or less lobed:
Humeri rounded. . . . . LEPTOPSINI.
Humeri angulated. . . . . RHIGOPSINI.

B. Side pieces of metathorax narrow, distinct:
a. Elytra connate, humeri rounded:
Eyes rounded, prothorax not or scarcely lobed. DYSLOBINI.
Eyes transverse, prothorax lobed. . . . OPHRYASTINI.
b. Elytra free, humeri distinct, wings perfect;
I. Mentum large, beak short, flat;
Antennal grooves very short, not oblique (eyes usually rounded and prothorax not lobed); outer stria of elytra entire . . . . . PHYLLOBIINI.
Antennal grooves longer, oblique, outer stria of elytra imperfect. . . . . TANYMECINI.
II. Mentum large, beak rather long. . . EVOTINI.
III. Mentum small, gula prominent; beak short, antennal grooves oblique, deep; eyes transverse, prothorax lobed in front. . . . . EUDIAGOGINI.

It will be seen after a short inspection of the characters above mentioned for the definition of the respective tribes, that the general arrangement in this family parallels in a remarkable manner that which I have developed in the Tenebrionidæ,* and which has been adopted by Dr Horn in his excellent monograph of that family, as represented in our fauna.† There is, namely, a higher series, characterized by large mentum and absence of wings, distinguished in the former case (Asididæ) by the ventral segments entirely corneous,‡ in the latter (A) by the indistinct side pieces of the metathorax. Then comes a second series, composed of two principal subseries, Blapsidæ in the former instance, with elytra widely extended on the flanks, and Tenebrionidæ with narrow epipleuræ, the first always apterous, the second mostly winged; in the present family we have (B–a) apterous, and (B–b) winged, and in the last, as in the genuine Tenebrionidæ, additional degradational characters in the oral organs, which, in the isolated genus Eudiagogus, have the same general form as in the short beaked species of the next family.

It is also worthy of remark that while the European species are

* Class. Col. N. America.

† Trans. Am. Phil. Soc., xiv, 253. sqq.

‡ The only instance in the Tenebrionidæ of this character, occurring outside of the Asidide series, is in a small group, Calcar, etc , otherwise allied to Tenebrionini.

very numerous, the representation in North America is but small, and that the highest form, Otiorhynchus, exists on this continent only as a few species imported with and parasitic on fruit trees, in the Atlantic States.

On examining closely the part of the head adjacent to the eyes, a small oblique suture will be seen extending downwards from the anterior inferior part; if this fissure is entirely closed, the eye is round, as in the majority of the genera; if it is open the eye becomes more or less pointed at that part, and finally assumes the transverse, acuminate form observed in Ophryastes, etc. My attention was first directed to this peculiarity, by observing that in the few species of Otiorhynchus now domiciled in the United States, there are quite perceptible differences in the form of the eyes, which are more rounded in *O. arcticus*, and more pointed in *O. ligneus*. In Agraphus this fissure is more distinct, and the eye is accordingly more pointed.

The groups of Otiorhynchini are distinguished by the tarsal ungues and antennæ, as follows:

Ungues separate;
  Antennæ long and slender, ... Otiorhynchi.
  Antennæ thicker, ... Trachyphloei.
Ungues connate at base, ... Periteli.

The tribe Brachyderini as here limited is by no means that defined by Lacordaire under the same name. I have removed from it various groups having the humeri distinct, which will be found below and under Tanymecini; Sitones and its allies do not even belong to this family, but will be found among the first Curculionidæ, where the simple mandibles and small mentum entitle them to be placed.

Thus diminished, the tribe, as represented in our fauna, indicates but two groups, distinguished by the form of the beak:

Beak longer than the head, feebly auriculate, antennal grooves commencing on the upper surface; support of deciduous piece very prominent, eyes coarsely granulated, somewhat pointed below. AMOMPHI.

Beak scarcely longer than the head, not auriculate, support of deciduous piece very prominent; eyes finely granulated, subemarginate in front . . . . . GRYNOMI.

The first group is represented by a single undescribed species from Colorado; the accessory mandibular pieces are short, pyramidal, obtuse, and slightly curved.

The second group is represented by two species on the Atlantic slope, belonging to Epicaerus and Graphorinus; the body is pyriform and robust; the accessory mandibular pieces are not preserved in any of my specimens, but the process which supports them is longer and more prominent than in any other group.

With the tribe Leptopsini, and the anomalous Rhigopsis described below, the series having the side pieces of the metathorax indistinct or invisible is concluded. They differ essentially by the outline of the front margin of the prothorax being sinuous when viewed laterally, so as to form a broad lobe for the protection of the eyes, when the head is deflexed; and correlative with this the tip of the prosternum is broadly and feebly emarginate. The eyes are more or less transverse and pointed below, though nearly round in Phyxelis. The beak is moderate or rather long, sometimes wider at tip, and auriculate (*Hylobius? torpidus* Lec. and *Tylodcres? gemmatus* Lec.,) very much as in Otiorhynchus. The antennal grooves are visible from above, but descend obliquely, towards the inferior angle of the eye, which however they do not reach. Panscopus and Phyxelis represent this tribe in the Atlantic States, and also a species which I refer to Strangaliodes; the Pacific representatives are the two species above named, each indicating a new genus. I have a remarkable ♀ specimen of *H.? torpidus*, having but 4 ventral segments, one of the two short segments being wanting.

The second great division of the Otiorhynchidæ, in which the side pieces of the metasternum are well defined, though always narrow, may be separated into two principal types, according to the form of the beak.

In the first, the beak is moderate, or rather long, more or less thickened, with the antennal grooves (as in all the preceding), somewhat visible from above, and either directed towards the eyes, or obliquely downwards; the prothorax is truncate at base, the elytra are connate, and the humeri are rounded. The eyes vary in form, and the prothorax is either lobed or not, according as the eyes are transverse or rounded.

Apical process of mandibles pyramidal, acute:
  Tibiæ with a terminal hook, ... Dyslobi.
Apical process not prominent:
  Tibiæ normal, truncate at tip, ... Ophryastes.
  Tibiæ expanded at tip, ... Trigonoscutæ.

In the second type the beak is flat above, usually channelled,

sometimes finely carinate, not expanded at tip; the antennal grooves are very narrow, parallel at their origin, and usually suddenly deflexed, though sometimes (Phyllobius) very short and straight. The eyes vary in form and the prothorax is lobed or not. The prothorax is usually bisinuate at base, with the hind angles acute, though sometimes truncate. The elytra are usually free, with prominent humeri, and the wings well developed: though sometimes they are connate, with rounded shoulders. The accessory mandibular piece is long and falcate in both, and the support at the tip of the mandible is circular and not prominent; characters of great moment when associated with the peculiar form of body.

Two tribes are indicated by a difference in the outer stria of the elytra:

Outer stria of elytra entire.	PHYLLOBIINI.
Outer stria of elytra abbreviated or interrupted . .	TANYMECINI.

The first tribe is represented by Pachnæus, and Phyllobius in the Atlantic States, and by Scythropus on both slopes of the continent. Of these Pachnæus has the eyes transverse, and the prothorax lobed at the sides in front, while in the others the eyes are rounded, and prominent, and the front outline of the prothorax is straight. The species are all winged, and the humeral angles are obtuse and well defined. The base of the prothorax is truncate in all the genera except Pachnæus, where it is distinctly bisinuate.

Macrostylus, a Brazilian genus recently found in Texas, is an anomalous member of this tribe. The antennæ are very long and slender, and the joints of the club seem to be quite separate and free. It is of very small size, and has the elytra connate and the humeral angles not prominent; the beak is not channelled, but otherwise resembles the beak of other members of the tribe. The claws are connate almost to the tip, as in Phyllobius, etc., while they are separate in Pachnæus. There are thus three groups indicated.

Prothorax lobed in front; claws separate: . . .	Pachnæi.
Prothorax not lobed; claws connate:	
Humeri prominent, elytra free:	Phyllobii.
Humeri not prominent, elytra connate: . . .	Macrostyles.

The Tanymecini resemble in form the Phyllobiini, but are readily distinguished by the outermost stria of the elytra being confluent

with the next about $\frac{1}{3}$ from the base, or abbreviated at that point, or interrupted, the continuation commencing behind the middle and extending to the tip. The prothorax is bisinuate at base (Compsa, Brachystylus and Brachythysus), truncate or feebly rounded in Tanymecus, Aphrastus, and the genera with connate elytra. The eyes are rounded and the prothorax not lobed in all of our genera.

Four groups are indicated in our fauna.

Elytra connate, humeri not prominent, ...	Symmathetes.
Elytra not connate, humeri angulated;	
Claws connate, ...	Aphrasti.
Claws separate;	
Prothorax truncate at base, ...	Tanymeci.
Prothorax bisinuate at base, ...	Cyphi.

Next to this tribe come the Entimini, large and brilliant insects of South America; the rostrum is stout, not so broad as in the last two tribes, deeply emarginate at tip, perpendicular on the sides, thickened below at the tip, with the antennal grooves deep and oblique; the apical scar of the mandibles is very large, circular and not prominent. The eyes are pointed below, and the prothoracic lobes large. The prothorax is comparatively small, and bisinuate at base; the elytra at base very broad, with prominent humeri, gradually narrowed and acute behind; the outermost stria is entire. The edge of the elytra and the ventral sutures are densely fringed with short hair; the claws are not connate.

Two insects presenting anomalous characters remain to be considered, each indicating a separate tribe.

The first is found abundantly in Oregon; the beak is two and a half times as long as the head, moderately slender, dilated and auriculate at tip, which is deeply emarginate; the grooves are visible from above, short, broad and deep, prolonged very indistinctly in an oblique direction; the apical scar of the mandibles is large and circular, but not prominent. The eyes are nearly round, and not prominent. The antennæ are slender, and not different in form from those of Otiorhynchus. The prothorax is rather small, a little narrowed in front, not lobed, truncate behind. Elytra wider at base than the prothorax, humeral angles obtuse distinct, feebly rounded at the sides, obliquely narrowed behind; scutellum distinct. First ventral segments feebly sinuate, the others straight; side pieces of metasternum distinct. Legs slen-

der, tibiæ feebly mucronate at tip; tarsi dilated, brush-like beneath, claws separate.

This species is from 10–11^{mm} ·4–·45 inch long, black, densely clothed with small cinereous scales, with lateral and dorsal vittæ of the prothorax, and scutellum pale yellow; the prothorax is sparsely punctured, and the elytra very feebly striate. I have named the genus Evotus. It is the *Otiorhynchus? naso* Lec. (Pac. R. R. Expl. and Surveys, p. 56).

The second of the anomalous forms above mentioned is a small, roughly tuberculate insect of the southern part of California, found under bark of yucca. It resembles in appearance the European Rhytirhinus, and shows unmistakable Byrsopide affinities. The mentum is, however, similar to that of the other Adelognaths of the present family, and the apical scar of the mandibles is distinct, flat and subtriangular, though without the central elevation usually seen. The tarsi are less dilated than usual, and sparsely ciliate beneath; the 3d joint is emarginate rather than bilobed, the claws separate. The rostrum is moderate in length, thick, irregular, not emarginate at tip, prominent above the eyes; the antennal grooves are deep and descend obliquely below the eyes which are pointed below, oblique and transverse. The scape of the antennæ extends nearly to the eyes; the funiculus is longer than the scape, 7-jointed as usual, with the 1st and 2d joints a little longer; club oval, pointed and annulated as usual. Prothorax strongly lobed behind the eyes, feebly emarginate beneath, broadly flattened (but not excavated) in front of the coxæ. The side pieces of the metathorax are *not distinct*, the 1st and 2d ventral segments are large, connate by a sinuated suture; 3d and 4th short, 5th longer than the 3d and 4th united, with a broad impression each side near the margin.

The species is of small size (5·5^{mm}) brown, covered with a dirt colored crust, very roughly reticulate above, with large deep pits; the humeral angles are sharp and prominent; there is a large tubercle on each elytron about $\frac{1}{4}$ from the tip, and another smaller one near the tip. I have named this singular insect *Rhigopsis effracta*.

The last tribe having an apical scar to the mandibles is Eudiagogini, represented by two species in the southern Atlantic States. The form resembles somewhat the Tanymecini, but is rather stouter and more convex; the color is black adorned with narrow stripes and bands of metallic scales.

The beak is short and stout, channelled above, feebly emarginate at tip, with the antennal grooves narrow and deep, running obliquely below the eyes, which are transverse and pointed below. The mandibular scar is small and triangular, not prominent. I have not seen the deciduous piece, but suppose it to be small, short and pyramidal. The mentum is retracted leaving a deep cavity, from the hind margin of which projects the gula in a small emarginate prominence, much like the mentum-tooth in certain Carabidæ. The prothorax is broadly rounded at base, with the hind angles nearly rectangular; the postocular lobes are large, and the front margin of the prosternum is nearly squarely truncate, so as to make a rounded right angle with the outline of the postocular lobe. The front coxæ are contiguous, the side pieces of the metathorax narrow, distinct; the ventral segments 1st, 2d and 5th long, 3d and 4th short; 1st and 2d sutures feebly sinuate, but in reverse directions. Legs moderate, tibiæ with a small terminal spur at the inner side; tarsi with 3d joint broadly bilobed, claws approximate, but not connate.

A singularly isolated type, seeming to have no relations with any other in our fauna.

CURCULIONIDÆ.

After thus separating the families above defined, there remains a vast complex of genera having the sexual characters of this series, the antennæ geniculate (with rare exceptions), the club always oval pointed and annulated, uniformly pubescent; the mandibles without deciduous piece, usually 3-toothed at tip, which is perpendicular. The mentum is always small or moderate in size, not concealing the maxillæ, and inserted upon a more or less elongated gular peduncle. The beak varies in form, as will be pointed out under the respective tribes; the antennal grooves rarely extend to the front extremity of the beak (as in all the members of Otiorhynchidæ), but commence at a greater or less distance from the tip (except in Sitonini). The front coxæ are either contiguous or separated; the side pieces of the metathorax are always distinct: the pygidium is either covered by the elytra, or exposed.

The following principal divisions may be established:

A. Antennal grooves extending to the base of the mandibles, gular peduncle broad, not emarginate; (*Brachyrhynchi*).

Beak short, broad, gular margin not prominent, eyes round. SITONINI.
Beak short, very thick, buccal cavity deep. . . . . BATHYRINI.
Beak moderately long, gular margin prominent, peduncle and mentum retracted. . . . . ALOPHINI.

B. Antennal grooves not extending to the base of the mandibles;
A. Gular peduncle broad truncate, mandibles emarginate at tip (antennæ not geniculate, claws toothed); . . . . . ITHYCERINI.

B. Gular peduncle long: (*Mecorhynchi*).

A careful analysis of the tribes composing the last division (Mecorhynchi) would extend this memoir to an unsuitable length for my present purpose, and must be reserved for the concluding part of my work on classification,* now in preparation. A few remarks upon the other four tribes, which might even be regarded as subfamilies, will however not be out of place. The types are well known with the exception of the second, Bathyrini, founded upon a very remarkable species from Arizona and Texas, which resembles somewhat a Cratoparis, of the family Anthribidæ; a resemblance increased by the hind angles of the prothorax in ♂ being expanded and flattened, so as to be as wide as the base of the elytra. The beak is not longer than the head, deeply constricted at base beneath, then suddenly expanded so as to be as broad as long, very thick, strongly channelled and deeply emarginate above. The antennal grooves are deep, extending to the base of the mandibles and flexed below the eyes, which are pointed below; the scape of the antennæ extends as far as the eye; the 1st joint of the funiculus is $\frac{1}{3}$ as long as the scape; the 2d is about $\frac{1}{2}$ as long as the 1st; the 3d–7th nearly equal in length, gradually a little thicker; club pubescent, oval, annulated as usual. The buccal cavity is very deep, and square. The gular peduncle is not visible, and the mentum small, narrow, and deep in the cavity; the mandibles are strong, their base very broad and transverse, the tip (so far as I can see) feebly emarginate. The prothorax is lobed behind the eyes, and the prosternum deeply, almost semicircularly, emarginate in front. The front coxæ are contiguous; the side pieces of the metasternum narrow; the sides of the elytra narrowly emarginate behind the humeri, scutellum transverse, wider behind; the sutures of the ventral segments are straight, and the segments less unequal than usual, the 3d and 4th

* Classification of the Coleoptera of N. America. Smithsonian Institution Miscell. Publications. 8vo.

together being longer than the others separately. The legs are short, the tibiæ truncate, feebly mucronate at tip, and with broad distinct *corbeilles;* the tarsi are broadly dilated, 3d joint deeply bilobed as usual; claws separate. I have named this genus Bathyris.

B. dispar; oblong oval, black, thickly covered with large dirty brown scales, varied on the elytra with patches of paler cinereous, and with scattered darker scales; of these the most conspicuous is a lateral transverse spot in front of the middle; a larger indistinct apical blotch is marked with an oblique brownish line; the stria are represented by ten rows of quadrate punctures; the outer one not abbreviated nor confluent; scutellum transverse, cinereous scaly. Length 4–6^{mm}

Arizona, Dr. Webb; Texas, Dr. Horn. The specimen from Arizona has the thorax at base as wide as the elytra, the hind angles being expanded, flattened and acute, with the side margin acute; the sides in front of the angles are straight and oblique.

Four specimens from Texas, which I considered as females, have the prothorax rounded on the sides, narrower in front, scarcely subsinuate at base, which is not as wide as the elytra, with the hind angles not prominent, but slightly rounded. The general form is therefore as in Eudiagogus. I have seen a nearly allied species from the Argentine Republic.

The Sitonini contain small species greatly resembling in form Tanymecus of the family Otiorhynchidæ, but differing entirely by the mentum being small, and the maxillæ exposed; the gular peduncle is short and broad, but quite distinct, and is truncate at the front margin. The mandibles are emarginate at tip, and have no apical scar for the attachment of the deciduous piece which is characteristic of the preceding family. The beak is short, broad, flat and channelled above, emarginate at tip; the antennal grooves extend to the base of the mandibles; they are deep and well defined, and flexed obliquely downwards below the eyes; the eyes are rounded; the front margin of the prothorax is not lobed, and not emarginate beneath. The front coxæ are contiguous, the side pieces of the metathorax are narrow and separate; the ventral segments less unequal than usual, the suture between the 1st and 2d sinuated. The tibiæ are truncate at tip, the tarsi dilated and brushlike beneath, the claws separate and simple. The elytra at base are much wider than the prothorax, with the humeri oblique and prominent; wings developed in all of our species.

The tribe Alophini retains a remnant of a form seen otherwise only in the preceding family; the elytra are convex, with the humeri not prominent and the prothorax is comparatively small. The prominence of the gular margin easily distinguishes it from all other tribes. The tibiæ are slightly mucronate at the inner angle of the tip, and the terminal surface is well defined, not lateral. The apical margin of the mandibles is curved, sharp and prominent, thus making the outer face broad and flat, with a well defined margin. *Liophlœus inquinatus* Mann, from Alaska, belongs to this tribe, and seems scarcely different from Alophus, except by the shorter and stouter funiculus. *Lepidophorus lineaticollis* on the other hand has an entirely different oral structure, and is apparently allied to Phytonomus, etc.

Ithycerus is a completely isolated form, having no relation with other genera. As pointed out by Dr. Horn,* the remark of Prof. Lacordaire, that the ♂ has 6 ventral segments, is an erroneous interpretation of the very convex last dorsal segment, which can be seen from beneath.

BRENTHIDÆ.

The species of this family are remarkable for the very elongate form, and by the great sexual differences which sometimes occur in the mouth organs. In our own *Eupsalis minuta* for instance, the beak of the male is broad, short and flat, with large prominent mandibles, while in the female the beak is long and slender, with very small mandibles. But two genera occur in our fauna; Eupsalis on the Atlantic slope from Canada to Texas, and Brenthus in Lower California.

The mouth is not constructed on the same plan as that of the long beaked Curculionidæ; the gular peduncle is wanting, and the mentum varies in form according to the shape of the buccal opening, which it nearly fills, thus concealing the maxillæ. The family is also easily known by the antennæ being 11-jointed, not clavate nor geniculate, nearly moniliform in Eupsalis, somewhat compressed and broader externally in Brenthus.

The eyes are rounded, the lenses are covered with a perfectly smooth membrane, and are consequently not granulated, the front coxæ are separated by the prosternum; the metasternum is long, and the side pieces are distinct and very narrow. The 1st and 2d

* Proc. Am. Phil. Soc. 1873, 447.

ventral segments are very long, and closely connate; 3d and 4th short, 5th as long as the two preceding united. The tibiæ are truncate at tip, the front ones feebly unguiculate, and with the inner margin of the tip concave; tarsi dilated, brushlike beneath, 3d joint bilobed in our genera, 4th joint long, claws simple separate; the tarsi are less dilated in some exotic genera.

The dorsal segments are arranged exactly as in true Curculionidæ; they are all membranous except the last, which is corneous and convex in ♀, divided in ♂: the sides of the ventral segments are only narrowly prolonged upwards, and are imbricated; the last spiracle is large and uncovered. The elytra have on the inner side the usual lateral fold, but instead of becoming obsolete near the tip, it diverges strongly from the margin and is continued quite to the suture, fitting to the lateral edge of the last ventral segments, thus showing an approach to the peculiar modification afterwards seen in Scolytidæ.

Some of the most curious characters in the Rhynchophorous series occur in this family. Among them I may instance *Taphroderus distortus* Westwood, from Natal, remarkable by the enormous development of the left mandible; and *Calodromus Mellyi* Guerin, from India, in which the 1st joint of the hind tarsi is as long as the whole body.

Series III. HETEROGASTRA.

I have named this series from the fact, that although the abdominal segments are alike in both sexes, and the ventrals also prolonged upwards at the sides, fitting into a groove on the inner face of the elytra, as in the Allogastrous series, yet the best characters for the separation of the families are to be found in the particular modification of the arrangement of the last ventral segments.

Nothing distinctive can be predicated of the series as a whole, except the similar pygidium in both sexes, and the prolongation upwards of the ventral segments to fit in the elytral groove.

The families may be thus distinguished:

A. Pygidium vertical or declivous:
  a. Antennæ geniculate, clubbed; labrum wanting:
     Last spiracle covered etc. (sub-families etc.) . . Calandridæ.
  b. Antennæ straight; labrum distinct:
     Last spiracle not covered by ventral segments; pygidium deeply notched to receive sutural apex of elytra. . . . Anthribidæ.

B. Pygidium horizontal; smaller:
  a. Antennæ geniculate, clubbed:
    Terminal edge of last ventral acute, surrounding the last dorsal; tibiæ generally compressed and serrate. . . SCOLYTIDÆ.
  b. Antennæ straight:
    Ventral segments very unequal, antennæ with annulated club. APIONIDÆ.
    Ventral segments nearly equal; antennæ with 11 separate joints. BELIDÆ.

CALANDRIDÆ.

Elytra with the usual fold on the inner face near the side very strongly developed; diverging behind, and becoming gradually effaced.

Ventral segments 3d and 4th shorter, 1st and 2d connate; lateral prolongations broad, imbricated; the sharp edge for reception in the elytral groove only developed on the 1st and 2d segments. Dorsal segments coriaceous, pygidium large, triangular, rounded at tip, declivous, alike in both sexes, though smaller in the third sub-family; last spiracle covered by prolongation of ventral segments.

An excellent synopsis of the United States species of this family has been published by Dr. G. H. Horn.*

According to differences in the form of the mouth, the indigenous genera may be divided as follows:

A. Pygidium exposed:
  Gular peduncle long, ... CALANDRIDÆ.
B. Pygidium covered by elytra:
  Gular peduncle broad, mentum concealed, . . . RHINIDÆ.
  Gular peduncle moderate, mouth normal, ... COSSONIDÆ.

The mouth in this sub-family is formed upon a peculiar type not seen in the genuine Curculionidæ; the gular peduncle is extremely long and narrow, leaving the maxillæ visible in the buccal fissures; the mentum is small, sometimes concave, and the palpi not usually visible. The mandibles are convex on their outer face and strongly toothed at tip as in many Curculionidæ. The beak is long, curved and cylindrical, the antennæ inserted at a distance from the mouth, geniculate, with a large club which is corneous and smooth at base, spongy and pubescent over the rest of the surface. The eyes are transverse and finely granulated. The

*Proc. Am. Phil. Society, 1873.

front coxæ are widely distant. The side pieces of the metasternum are large, and those of mesosternum also large, ascending obliquely. The hind coxæ are oval, and widely separated, the tibiæ are slender, sinuate, strongly unguiculate at tip, with the articular surface lateral; tarsi usually dilated, and brushlike beneath, sometimes narrow and not scopiferous; last joint rather long, claws simple, separate.

Rhinidæ.

Again a different modification of mouth is seen in this sub-family. The gular peduncle becomes a broad short plate projecting forwards, forming the floor of the mouth, within which the mentum is concealed. The mandibles are smooth and very convex on the inner face, while the outer face is rough and flattened, and the teeth project outwards. The beak is long and slender. The antennæ are geniculate, the club is smooth and corneous at base, spongy and pubescent for the rest of the surface. The eyes are large and coarsely granulated, and meet on the under surface of the head. The front coxæ are very narrowly separated, the under surface of the body, and the dorsal segments are as in Calandridæ, except that the pygidium is covered by the elytra. Tibiæ slender, strongly hooked at tip, tarsi narrow, 3d joint bilobed, ciliate at the sides, not pubescent: 4th joint long, claws simple, separate.

A small black species of Rhina has been found by Mr. G. R. Crotch, in the trunks of Yucca in the Mohave Desert of California; otherwise the genus occurs generally in tropical America.

Cossonidæ.

With the same arrangement of abdominal segments above described, these insects have an oral structure similar to that of the Hylobiini in the true Curculionidæ. The gular peduncle is moderately long, the mentum distinct, and palpi large. The mandibles are normal in form, convex externally, toothed as usual at tip. The beak is moderate, or (Rhyncolus) short and stout. The eyes transverse, moderately finely granulated. The antennæ geniculate, rather stout, club oval annulated, pubescent. Front coxæ separate, tibiæ hooked at tip, tarsi narrow, 3d joint not dilated. Pygidium covered by the elytra, smaller than in the two preceding sub-families.

SCOLYTIDÆ.

The members of this family, which contains some of the most destructive enemies of forest trees, may be easily recognized by

the peculiar arrangement of the last ventral segment, which is prolonged upwards along the whole lateral and apical margin, so that the pygidium is confined entirely to the dorsal surface, and, as it were, surrounded by this sharp edge.

The mouth is normal in form, the gular peduncle emarginate, the mentum moderate in size, prominent, buccal fissures broad, maxillæ exposed. Mandibles stout, curved, convex on the outer face, toothed on the inner side. Beak short, or almost wanting, antennæ short, geniculate, club usually solid, annulated on one or both sides, base usually smooth and corneous for a greater or less extent; rarely (Phlœotribus) the club is lamellated. Eyes usually large and transverse.

Front coxæ usually contiguous and subconical, hind coxæ large, not widely separated; tibiæ compressed, usually serrate on the outer edge, terminal spur large; tarsi sub-pentamerous, not spongy beneath, 3d joint sometimes narrow, sometimes dilated; 4th joint usually rudimentary, sometimes (Platypus) quite distinct, last joint long, claws simple, separate, strong.

The ventral segments are not very unequal in length, and the suture between the 1st and 2d is straight and well marked, the 5th is frequently the longest; the intercoxal process of the 1st is usually acute.

The dorsal segments are membranous, the pygidium is small and horizontal, covered by the elytra: the last spiracle is visible; the lateral upward prolongations of the ventral segments are well marked, and furnished with a sharp edge, continued even to the tip of the 5th segment. The lateral fold of the elytra is consequently well marked, the groove narrow and deep, gradually obliterated, but not wider toward the tip.

Two sub-families are indicated, Platypodidæ and Scolytidæ, the 1st with the basal joint of the tarsi very long, and the 4th distinct; the latter with the 1st joint shorter than the others united, and the 4th joint less developed.*

The synonymy of our species will probably present much difficulty, and the number is by no means that indicated by the names

* On p. 369, of vol. vii of the Genera des Coléoptères, Lacordaire has established a tribe Eutomides, which differs from all the others in having the flanks of the prothorax separate from the pronotum by a distinct edge; and the mass of the antennæ composed of 7 lamellate joints. These characters are so foreign to the Rhynchophora, that I cannot help suspecting that these insects have been misplaced. I sought for specimens in all of the large European collections which I visited, but without success.

in the catalogues. The only connected series of descriptions is contained in the synopsis by Dr. Zimmermann, with an appendix by myself,* in which differential characters are given for the definition and distinction of each species. Many of the same have been described by Mr. Eichoff,† with diagnoses only, and no comparative or differential characters. For their identification, therefore, comparison of specimens will be necessary, or the completion of the promised monograph of the family from the hands of that author must be awaited.

ANTHRIBIDÆ.

In this family of the Rhynchophora there is as near an approach to the normal Coleoptera as is observed in Rhinomaceridæ, the first family herein defined.

The beak is short or moderate, depressed above, with the antennæ inserted in foveæ or short grooves which are usually lateral, rarely (Choragus, etc.) on the upper face; the antennæ are not geniculate, with 11 distinct joints, rarely (Hormiscus) but 10: the scape is not elongated. The labrum is quite distinct; the mouth is normal in structure, the gular peduncle large and deeply emarginate, with the mentum and ligula received in the emargination, the maxillæ are exposed and have two distinct lobes, a character unknown in the preceding families, except in some Platypodidæ; mandibles flattened, curved and acute at tip, toothed on the inner side. Eyes large, rather finely granulated, rounded or emarginate. The front coxæ are contiguous or narrowly separated, rounded; the pronotum is sharply margined behind, and the margin is frequently distant from the base, curved forwards at the sides. The side pieces of the metasternum are distinct. The ventral segments are nearly equal, and rather closely connected, except the 5th which is free: the lateral prolongations are rather wide, *not imbricated*, and the sharp edge is well marked. The dorsal segments are membranous, except the pygidium which is rather large, deflexed and only partly covered by the elytra; the last spiracle is large and visible when the elytron is raised; the base of the pygidium is very deeply notched (so that the uncovered part appears slightly emarginate), and the sutural edge of the elytra (which is grooved for its whole extent) is bent down

* Trans. Am. Ent. Soc., ii, 141, Sept., 1868.
† Berliner Ent. Zeitschrift, 1868 et sqq.

and slightly prolonged at tip so as to fit into this excavation. The lateral fold of the inner surface of the elytra is well marked for the middle third, but is distant from the side, and gradually obliterated behind, following along the 2d line of punctures from the side. The tibiæ are slender, truncate at tip, with feebly developed spurs, never mucronate; the tarsi are dilated and brush-like beneath, the 2d joint usually deeply emarginate, receiving the 3d joint in the emargination: the 3d is usually narrower and shorter than the 2d and also emarginate: the last joint moderate in length, claws separate toothed.

As observed by Lacordaire,* when the sexual differences are well marked the male is larger than the female, and the beak of the latter is shorter: the reverse being the case in all other families of Rhynchophora. There are also sometimes great differences in the antennæ and front legs which are much longer in the male.

The larvæ of some species of Brachytarsus (*Anthribus* Geoff.) are parasitic on certain species of Coccus: the only example thus far ascertained of carnivorous habits among the Rhynchophora.

APIONIDÆ.

In this family the last dorsal segment is horizontal and small as in the Scolytidæ, but the other characters are quite different.

The beak is long and slender, the mouth small, the gular pedunclc rather narrow and emarginate, the mandibles feeble, and acute. The antennæ are not geniculate, the scape is somewhat elongated; they are inserted on the side of the beak at or above the middle, and the grooves are very short; the eyes are rounded, rather coarsely granulated.

The prothorax is not lobed in front, the coxæ are contiguous, conical and prominent. The side pieces of the metathorax are distinct, narrow. The tibiæ are slender, truncate at tip; hind pair without spurs; the claws are separate, more or less toothed at the base.

The dorsal segments are membranous: the last segment (pygidium) is horizontal, rather small and corneous, entirely covered by the elytra; at the side it meets only the 5th ventral, and the last spiracle is not apparent: the ventral segments are very unequal,

* *l. c.* vii, 480.

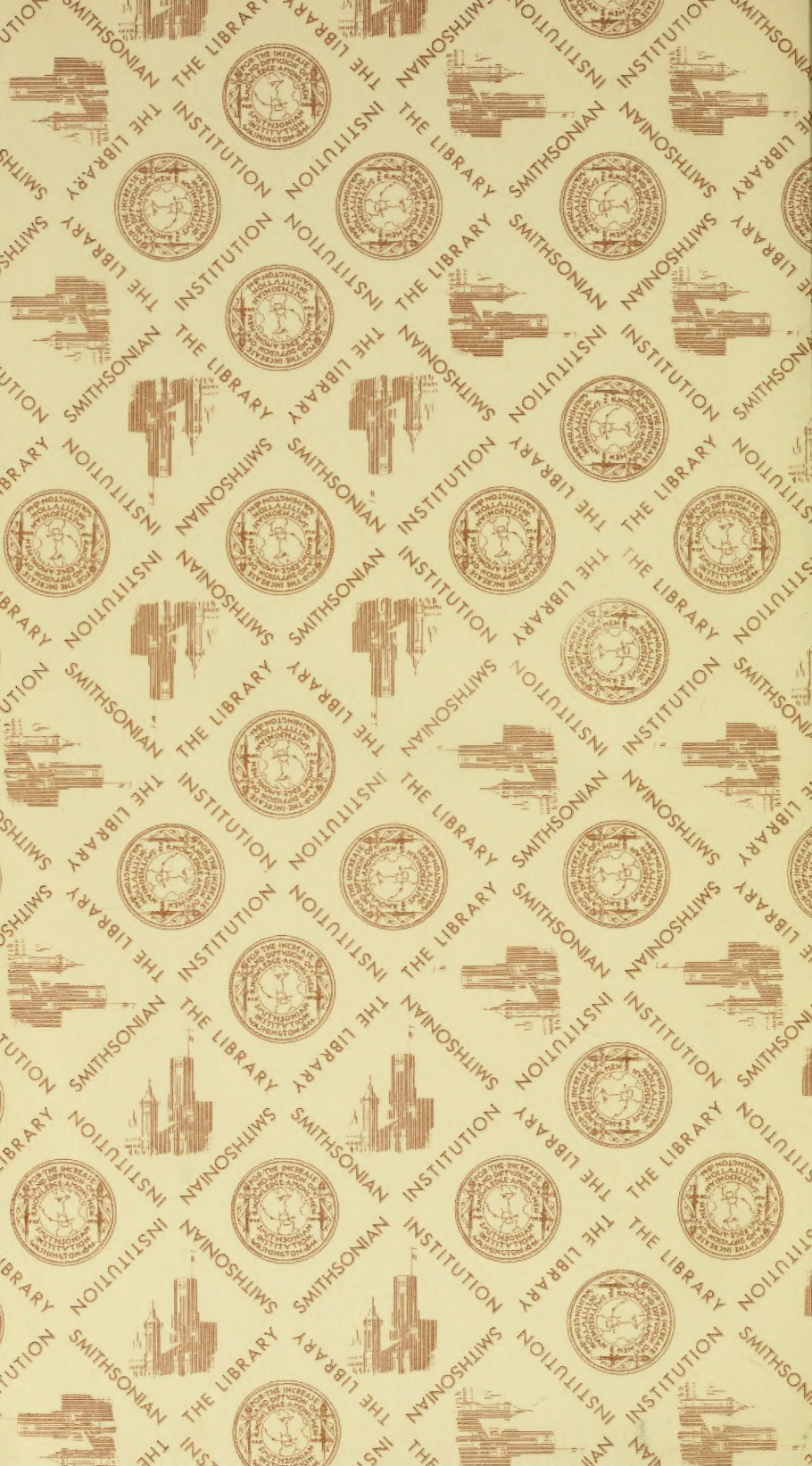
the 1st and 2d very large connate, 3d and 4th very short, sutures straight: lateral prolongation very narrow: groove on the inner side of elytra narrow, gradually broader behind, fold extending nearly to the suture (somewhat as in Brenthidæ).

This family is represented by Apion, a genus containing a large number of small species of pyriform body, and altogether peculiar and of easily recognized appearance. So far as I have examined them they have well developed wings, though Lacordaire mentions that the body is apterous. This family is related to the Erirhine tribe of true Curculionidæ.

BELIDÆ.

The Australian genus Belus, and the South American Homalocerus, on examination present so many differences that I have separated them to form a new family, which must be placed in the present series. In fact, with a form of body greatly resembling Lixus of the true Curculionidæ, they have the dorsal abdominal segments of Apion; the ventral segments are, however, equal or nearly so; the lateral prolongation is very narrow, and although the edge is acute, the lateral fold on the inner face of the elytra extends only in the middle third, and is nearly confluent with the margin at its front end. The antennæ are slender, 11-jointed, straight, and the scape is moderately long. The tibiæ are slender, truncate at tip, and the hind pair have two small but distinct spurs as in normal Coleoptera.

In the ♂ of Belus the apex of the elytra is prolonged as in many species of Lixus; and this family seems related to the Cleonine tribe of Curculionidæ as Apion is to the Erirhine. A slight trace of epipleura may be observed at the front part of the elytral side margin, thus showing also a relationship with the Rhynchitidæ of the first series, in which, as I have above mentioned there is a feeble fold on the inner face of the elytra about the middle, but quite distant from the margin.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